

WHAT IS CLAIMED IS:

1. A fiber-semiconductor laser source
comprising an optically pumped VCSEL and a fiber
5 amplifier for the laser output of said VCSEL which are
optically pumped by a common optical pump source.

2. A laser source according to claim 1 wherein
said optical pump source produces a pump laser output
10 with a wavelength λ_1 and said VCSEL produces a VCSEL
laser output with a wavelength λ_2 .

3. A laser source according to claim 2 wherein
said optical pump source is a diode laser.

4. A laser source according to claim 3 further
including means for deriving first and second pump
laser beams from the laser output of said diode laser,
first means for injecting said first laser beam into
15 said VCSEL and second means for injecting said second
laser beam into said fiber amplifier.

5. A laser source according to claim 4 wherein
said fiber amplifier comprises a doped optical fiber,
and further including means for injecting said VCSEL
laser output into said fiber and means for extracting
the amplified VCSEL laser output from said fiber.

6. A laser source according to claim 1 wherein
said fiber amplifier comprises a doped optical fiber
having one end disposed to inject said pump laser
output into said VCSEL whereby to cause said VCSEL to
produce said VCSEL laser output, and further including
a multiplexer connected to the opposite end of said
doped optical fiber and coupled to said optical pump
source for (a) injecting said pump laser output into
said fiber and (b) coupling said VCSEL laser output to
an optical device.

7. An efficient laser source comprising a pump
laser for emitting a pump laser beam at a wavelength
 λ_1 , a vertical cavity surface emitting laser (VCSEL),

means for directing said pump laser beam into said VCSEL so as to cause said VCSEL to emit a VCSEL laser beam at a wavelength λ_2 , an optical gain fiber, and light coupling means for (a) directing said VCSEL laser beam into said optical gain fiber and (b) injecting said pump laser beam into said optical gain fiber so as to provide amplification for said VCSEL laser beam.

8. A laser source according to claim 7 wherein said pump laser beam is collimated, and further wherein said light coupling means comprises:

a first diachronic beam splitter which is adapted to reflect and transmit light of wavelength λ_1 and to transmit light of wavelength λ_2 , said beam splitter being disposed so as to reflect a portion of said pump laser beam into said VCSEL and also to receive and transmit the VCSEL laser beam emitted by said VCSEL;

a second polarization dependent beam splitter disposed to receive the VCSEL laser beam output from first beam splitter, said second beam splitter being

adapted to reflect said VCSEL laser beam according to
a first VCSEL beam polarization and to transmit said
same laser beam according to a second polarization
rotated 90 degrees from said first beam polarization;

5 means for receiving said VCSEL laser beam
reflected by said second beam splitter and injecting
same into one end of said optical gain fiber;

reflector means for injecting said pump laser
beam into said optical gain fiber;

10 a Faraday rotator mirror coupled to the opposite
end of said optical gain fiber for receiving the VCSEL
laser beam reflected from said second beam splitter,
rotate the beam polarization by 90 degrees, and
reflect the VCSEL beam with rotated polarization back
15 along optical gain fiber for transmittal through said
second beam splitter; and

optical output means for receiving the reflected
VCSEL laser beam with rotated polarization that is
transmitted through said second beam splitter.

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9. An improved laser source comprising:

a vertical cavity surface emitting laser (VCSEL);
a pump laser for generating a single mode output
beam at a wavelength λ_1 ;

diachronic beam splitter means for receiving said
5 pump laser output beam and dividing the power of that
beam so as to form a first and second beams of like
wavelength λ_1 , said beam splitter being positioned so
that one of said beams is injected into said VCSEL so
as to cause said VCSEL to emit a VCSEL laser beam at a
10 wavelength λ_2 ;

an optical gain fiber; and

light coupling means for directing said VCSEL
laser beam into said optical gain fiber and for
injecting the other of said first and second beams
15 from said pump laser into said optical gain fiber so
as to provide amplification for said VCSEL laser beam.

10. An improved laser source according to claim
9 wherein the other of said first and second beams of
20 wavelength λ_1 is coupled to said gain fiber by
reflection from a plurality of mirrors.

11. An improved laser source according to claim
9 wherein said VCSEL has a movable mirror and a fixed
internal mirror aligned with its vertical cavity, and
5 further wherein said pump laser and said beam splitter
are arranged so as to couple said one beam of
wavelength λ_1 to said VSCEL via transmittal through
said fixed mirror.

12. An improved laser source according to claim
9 wherein said VCSEL has a movable mirror and a fixed
internal mirror aligned with its vertical cavity, and
further wherein said pump laser and said beam splitter
are arranged so as to couple said one beam of
15 wavelength λ_1 to said VSCEL via said transmittal
through said movable mirror.

13. An improved laser source according to claim
9 wherein said light coupling means comprises a
20 diachronic mirror disposed so as to receive said VSCEL
laser beam and the other of said first and second

beams from said pump laser and to direct them into said optical gain fiber.

14. An improved laser source according to claim 9 further including an optical lens for directing said VSCEL laser beam and the other of said first and second beams from said pump laser into one end of said optical gain fiber.

15. An improved laser source comprising:
a vertical cavity surface emitting laser (VCSEL);
an optical gain fiber having one end optically coupled to the output side of said VCSEL;
a pump laser for generating a single mode pump laser beam at a wavelength λ_1 ; and

a wavelength division multiplexer having first and second input ports and an output port, with said first input port coupled to said gain fiber and said second input port coupled to said pump laser, said multiplexer being adapted to (a) inject said pump laser beam into said gain fiber to optically pump said

VCSEL and thereby cause it to emit a VCSEL laser beam that is injected into said one end of said gain fiber, and (b) pass said VCSEL from said gain fiber to said output port for extraction from said source, VCSEL
5 laser beam being amplified by said gain fiber during its transit to said output port.

16. An improved laser source according to claim
15 wherein said pump laser is a pulse laser, and said
10 multiplexer is adapted to alternately inject pump laser pulses into said VCSEL and to pass said amplified VCSEL laser beam to said output port.